TECHNICAL EDUCATION IN INDIA.

SIR AUCKLAND COLVIN, the Governor of the North-Western Provinces of India, has issued an exhaustive minute on technical education in that country, in which the various steps towards the introduction of this system of instruction are summarized. The minute naturally refers chiefly to the North-Western Provinces, but is in fact a summary of what has been done elsewhere. It seems that the idea of introducing technical education in the North-West Provinces, where there has hitherto always been a steadily increasing demand for University education, was first mooted in September 1885, when the attention of the local Government was called to the Madras scheme, which aimed at promoting instruction in industrial arts and manufactures by offering grants-in-aid to encourage the teaching, in schools so aided, of technical science, arts, and handicrafts, and by testing that teaching by a system of public examinations. Nearly a year later the Home Secretary to the Government of India drew up a note on the subject generally, pointing out that there was room for improvement in this branch of education in the great north-west, and inquiring what was being done. The Director of Public Instruction replied that the question of establishing Faculties of Medicine and Engineering was under consideration in the Allahabad University, and also certain preparatory courses of study, while it was proposed to refer the question of agricultural and veterinary schools to the Local Records Department. In January 1888, Colonel Forbes, replying to questions addressed to him regarding instruction in engineering, said he considered that the practical instruction gained by natives in the large railway workshops at Allahabad, Lucknow, and Lahore, and at the Government workshops at Roorkee, was decidedly bearing fruit in the direction of enabling natives to take intelligent and independent control in these branches of technical industry. The railway and Government workshops he considered were the real technical schools so far as this branch of instruction was concerned, and there was no need, therefore, for the Government to establish technical engineering schools. Facilities might be given to selected students at the middle and high schools to go through a four or five years' course at these workshops, but more than that he held was unnecessary. Colonel Brandreth, the Principal of the Thomason College, was unfavourable to any school for technical education for the youthful masses, but would provide special opportunities for exceptional young men, though such opportunities need only be limited in number. "For the higher grades of engineering, I think the ordinary liberal education with a scientific knowledge is most suited, until a man is of an age to know his mind, and elect for the profession, when there should be a strictly technical education for a limited time, two or three years, followed by a careful apprenticeship on works." The late Colonel Ward contended that facilities should be given at the Roorkee College for practical instruction, in addition to the present theoretical course. "If such a technical practical class were formed at Roorkee, students from the schools might be allowed to attend it without going through the College theoretical course." Later on, the Director of Land Records and Agriculture sent in an opinion on the subjects immediately referred to him, and advocated nothing more than the creation of a normal school for survey only, at Cawnpore or Lucknow, suggesting also the establishment of small scholarships for the maintenance of boys in training at the various workshops in the provinces; of an art school at Lucknow; and of agricultural and veterinary schools or classes in high schools; and he proposed that drawing should be made compulsory, competency to teach drawing being prescribed as an essential qualification in all teachers in middle and high class schools. And finally, the Inspector-General of Civil Hospitals reported against the proposal to teach up to a higher standard than that of the hospital assistant class. Then, in March 1888, the Director of Public Instruction forwarded a second report adverse to the establishment of a school of art at Lucknow, and pointing out further that, however desirable was the proposal to introduce drawing into public schools, there were no funds available for the purpose. At the close of the year the Director forwarded a resolution, on the part of the Senate of the Allahabad University, to the effect that any steps to establish a College for training medical practitioners would at present be premature. At this point, says the *Times of India*, in discussing Sir Auckland Colvin's minute, the cold water current ceased. In the February of last year the Director of Public Instruction forwarded a minute by the Allahabad Senate, it which it was decided to establish a Faculty of Engineering, degrees being conferred on men who had passed at least a three years' theoretical course at a properly constituted Engineering College or school. On this subject Sir Auckland Colvin now reports that, so far as he is able to gather, the only place at which engineering can be studied in the North-West Provinces is Roorkee. The Public Works Department, he adds, is of opinion that if degrees are to be conferred by the Allahabad University the Roorkee certificate must be abolished, and the Department prefers Roorkee certificates. In this dilemma the resolution of the Senate has not yet been forwarded to the Government. Then the establishment by the University of a special examination of "a commercial and practical character," aiming apparently at forming a sort of training class for technical education, still remains under consideration. The general conclusion, Sir A. Colvin thinks, is that, on the whole, opinion points to nothing more urgent or pronounced than the expediency of giving greater facilities for obtaining instruction in the subordinate grades of practical engineering, and in the handicraft of the artisan. Sir Auckland Colvin then sums up the subsequent papers on the subject, relating to the offer of the British Indian Association, in July 1887, to establish and maintain, at a cost to the Association of Rs. 500 per month, a school of industry in one of the Wingfield Manzil buildings; the announcement of Munshi Imtiaz Ali of additional individual subscriptions, reaching Rs. 17,440 per annum; to the speeches of Sir Alfred Lyall on the subject; and to the draft rules forwarded by the British Indian Association.

Sir Auckland next devotes himself to a consideration of the systems of technical instruction at work in Bombay and Bengal. From a careful study of the facts and the more or less voluminous papers in which they were originally enshrined, he proceeds to define what is meant by technical education so far as it is applicable to the North-West Provinces. Technical education in Europe he illustrates by Mr. Scott Russell's words: "It is necessary that each individual shall, in his own special profession, trade, or calling, know more thoroughly its fundamental principles, wield more adroitly its special weapons, be able to apply more skilfully its refined artifices, and to achieve more quickly and economically the aim of his life, whether it be commerce, manufactures, public works, agriculture, navigation, or architecture;" and by an extract from Mr. Kirkham's report, in February 1889, to the Bombay Government: "The general principles that the real technical school is the actual workshop—that actual workshops are only called into existence by capital operating in accordance with its own law—that this training, so far as it can be given in schools or colleges, must be, in the main, preparatory and disciplinary, and that the improvement of science teaching all round, and the spread of a practical knowledge of drawing, are the indispensable preliminaries of any form of practical training." But however unanimous the authorities may be so far as the principle of the matter is concerned, directly they come to the practical details there is, as Mr. Kirkham admits, every degree of diversity of opinion, and every system is of course bound in a way to differ from every other system, just as the leading industries of different districts differ. Apart from this, however, the Bombay system was found to be far too elaborate for the North-West Provinces. From Bengal Sir Alfred Croft wrote a very practical and sensible letter, condemning the abolition of the Seebpore workshops, and urging that the primary point, so far as engineer students were concerned, was to learn how to use their hands. He also quoted Mr. Spring, who says there can be no question as to their superiority for public works employment if the men have gone through the course of manual training. "An engineer who has learned to use his hands is, other things being equal, an all-round better and more useful man than one who has not." Sir A. Croft goes on to further condemn the removal of the Seebpore shops from the point of view of the need of the mechanic class. "It may be freely admitted and taken as proved that the maintenance of the shops is undesirable from the point of view of the Public Works Department. But it is no less clear to me that the interests of that Department are in this matter antagonistic to those of technical education; and that the deliberations of the Committee have been chiefly governed by regard to the former." The Government, however, remained in principle unmoved; but happily in practice they agreed with the Director of Public Instruction, and the Government of India followed suit; thus establishing a very important principle in regard to technical education. Armed with all this experience, and conceding for the moment the

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existence of a demand for men competent to deal with machinery and familiar with all the lower forms of engineering, Sir A. Colvin proceeds to discuss what course the training should take, how best to secure it, and the sources from which the necessary funds could be obtained. With regard to the first point, he thinks that what would mostly be required are facilities for gaining a competent theoretical and practical knowledge of the more subordinate grades of mechanical engineering, such as is necessary to a foreman mechanic, more especially in connection with the steam-engine, the railway workshops, and the iron-foundry; and also of the processes of cotton-spinning as employed in the mills established in the North-West Provinces. "These are the two great branches of industry which in Bombay have been recognized as fields for native labour: which, though in a lesser degree, exist here (in the North-West Provinces), and in regard to which, at present, specialized means of instruction are unquestionably, in these provinces, wanting." With regard to the second point, there exists at Roorkee a Government Engineering College and Government workshops, and it seems probable that these will form the nucleus of the instruction necessary. As to the third point, Sir Auckland Colvin thinks it would be premature to enter into the question of funds until the dimensions of the scheme are definitely decided upon. Finally, to see how far all these views meet the industrial needs of the province, Sir Auckland has decided to seek the aid of a strong Committee, which will obtain from all available quarters information on the points indicated in the minute, deputing members to Calcutta, Bombay, and Madras, and subsequently reporting to Government the result of its inquiries, with its own recommendations, and with full details of any scheme which it may desire to see carried into effect.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The judges for the Johnson Memorial Prize, 1891, have awarded the prize to Mr. M. S. Pembrey, B.A., Christ Church. The judges also select the essays of the following as worthy of mention: Mr. T. J. Pocock, Scholar of Corpus Christi College, and Mr. F. T. Howard, B.A., Balliol College. The Johnson Prize consists of a gold medal of the value of ten guineas, together with the surplus dividends on the money invested. The prize is awarded every fourth year to the candidate who produces the best essay on some subject connected with astronomy or meteorology. The selection of a subject is left to the discretion of the candidates. This year there were six candidates.

Mr. Pembrey was a Fell Exhibitioner of Christ Church, gained a first class in the final honour school of natural science in 1889 (physiology), and obtained the Radcliffe Travelling Fellowship in 1890. Mr. Pocock was placed in the first class of mathematical moderations and also in the final mathematical schools, Trinity term 1891. Mr. Howard was placed in the second class of the final honour school in natural science (geology), and obtained the Burdett-Coutts Scholarship in 1890.

SOCIETIES AND ACADEMIES.

LONDON.

Chemical Society, June 18.—Prof. A. Crum-Brown, F.R.S., President, in the chair.—The following papers were read:—A note on some new reactions of dehydracetic acid, by Dr. J. Norman Collie. In preparing dehydracetic acid, by passing ethyl aceto-acetate through a red-hot tube, it is stated that alcohol is formed; the author finds that large quantities of ethylene gas and acetone are also produced. Dehydracetic acid is also volatile to a considerable extent with steam, and is decomposed by boiling with water to a small extent into carbon dioxide and dimethylpyrone. This latter decomposition is more readily effected by boiling the acid with strong hydrochloric acid. If 50 grams are boiled with ordinary fuming hydrochloric acid, the whole is converted into carbon dioxide and a soluble compound of dimethylpyrone with hydrochloric acid. The barium salt of dehydracetic acid, $(C_8H_9O_5)_2Ba$, seems to be not a salt of the compound $C_8H_8O_4$, but of the true tetracetic acid, $C_8H_{10}O_5$. A very stable copper salt of the formula $C_{24}H_{25}O_9N_3Cu$ is obtained if dehydracetic acid be added to a solution of copper acetate in a large excess of ammonia.—The lactone of triacetic acid, by Dr. J. Norman Collie. In a former paper on the constitution of dehydracetic acid (Trans. Chem. Soc., 1890, 189) the author pointed out that if the formula which he proposed for dehydracetic acid was correct, it would be the δ-lactone of tetracetic acid. And the following list was given showing the connection between the condensed acids formed from acetic acid: $CH_3CO.(CH_2CO)_2.CH_2COOH$, tetracetic acid; $CH_3CO.CH_2CO.CH_2COOH$, triacetic acid; CH_3COCH_2COOH, diacetic acid; CH_3COOH, acetic acid. At that time no acid corresponding to the triacetic acid was known. Since then the author has obtained the lactone of this acid by the action of 90 per cent. sulphuric acid on dehydracetic acid at a temperature of 130°–135°. The properties and reactions of the new compound are described.—The refractive power of certain organic compounds at different temperatures, by Dr. W. H. Perkin, F.R.S. The magnetic relations of substances when examined at temperatures wide apart show that certain variations take place after allowing for change of density. Experiments have been made by the author in reference to the refractive power of liquids under similar circumstances. The results show that the specific refractive power is not constant for all temperatures. By comparing the lines A and F it was found that the dispersion was slightly diminished by rise of temperature. The results were calculated by the formula $\frac{\mu - 1}{d}$. When calculated by Lorentz's formula the numbers gave higher results for high temperatures than for lower ones.—Note on a volatile compound of iron and carbonic oxide, by Ludwig Mond, F.R.S., and Dr. F. Quincke (see NATURE, July 9, p. 234).—The formation of salts, a contribution to the theory of electrolysis and of the nature of chemical change in the case of non-electrolytes, by H. E. Armstrong. The author draws attention to the recent researches of Claisen, W. Wislicenus, and others, which clearly show that ethereal salts form compounds with sodium ethylate, and to the bearing which these results have on the theory of the formation of salts generally. It may be supposed that the acid and the "base" in the first instance combine, and that the salt is formed by subsequent interactions within the molecule. In like manner, acids form dissociable compounds with water, and by the occurrence of change within such systems, under the influence of electromotive force, electrolysis is effected. When the compound is highly unstable, the opportunity for change within its system is slight, the acid is a weak one, and its solution of relatively low conducting power. In the case of non-electrolytes, the occurrence of change may be supposed to occur within complex systems formed by the union of the interacting substances.—Dibenzyl ketone, by Dr. S. Young. The author finds that, in preparing the ketone by heating calcium phenyl acetate in a combustion furnace, only 27 per cent. of the theoretical yield is obtained. However, if the calcium salt be heated by means of the vapour of boiling sulphur, the yield of pure ketone amounts to 76·6 per cent.—The vapour-pressures of dibenzyl ketone, by Dr. S. Young.—The vapour-pressures of mercury, by Dr. S. Young. Two additional observations of the vapour-pressures of mercury at 183°·75 and 236°·9 have been made, and, from the previous results of Ramsay and Young, the boiling-point and the vapour-pressures of mercury have been recalculated.

June 25.—Extraordinary General Meeting.—At the request of certain Fellows to the President, an extraordinary general meeting was summoned to consider a proposal for amending and altering the by-laws. The proposal was moved by Mr. James Wilson and seconded by Dr. Teed. Mr. Cartrighe moved the following amendment: "That this meeting declines to pledge itself to any amendment or modification of the by-laws which has not been approved and recommended to the Fellows for adoption by the Council." Sir F. A. Abel seconded the amendment. Mr. Cassell, Mr. Lloyd, and Dr. Newton spoke in favour of the original motion. Prof. Tilden, Mr. Warington, Mr. Page, Dr. Odling, and Mr. Friswell spoke in favour of the amendment. The amendment was carried by 137 votes to 47 votes.

PARIS.

Academy of Sciences, July 13.—M. Duchartre in the chair.—Calculation of the mean length that a circular tube widened at one end should have in order that a sensibly uniform *régime* might be established, and on the expenditure of the charge that entails the establishment of this *régime*, by M. J. Boussinesq.—Contribution to the study of what are called *natural* prairies, by M.

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